

# Materials in Energy

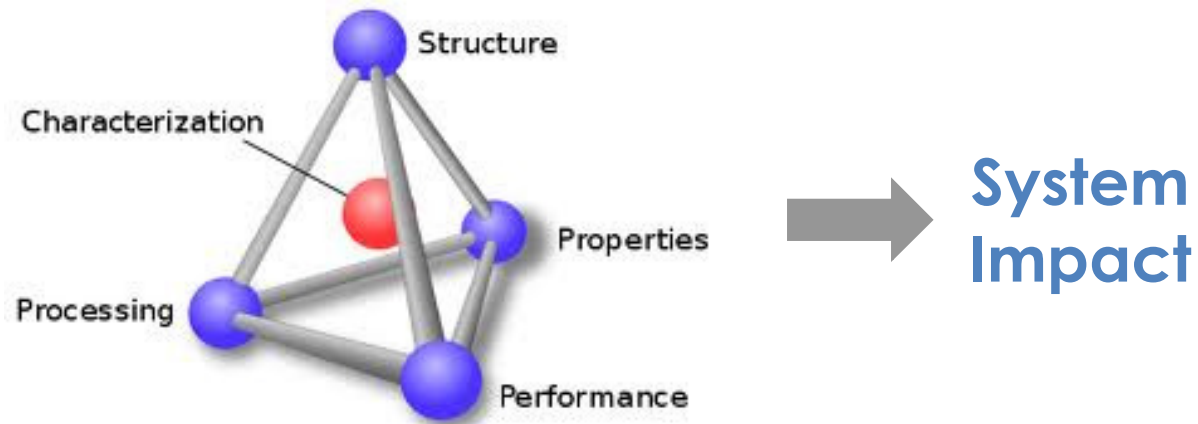
Essential Platform Technologies  
for Innovation in Energy

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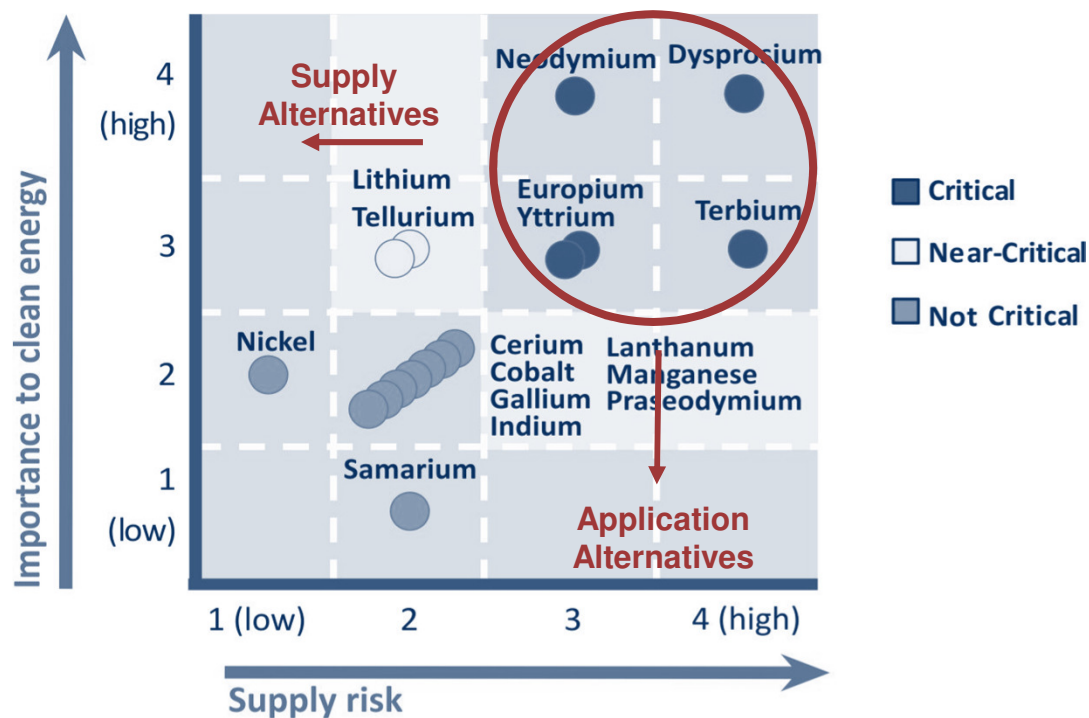
# Categories of Material for Energy

- Critical Materials
- Enabling Materials
- Intelligent Materials



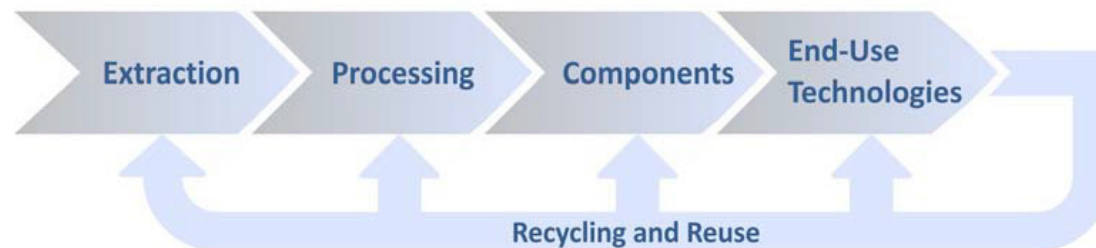
**ARPA-E looks for creating system-level breakthroughs  
through materials science innovations**

# Criticality of Materials



## End Uses

- Vehicles
- Wind Turbines
- Lighting
- Photo-voltaics
- Fuel Cells
- Refining
- Gas Turbines

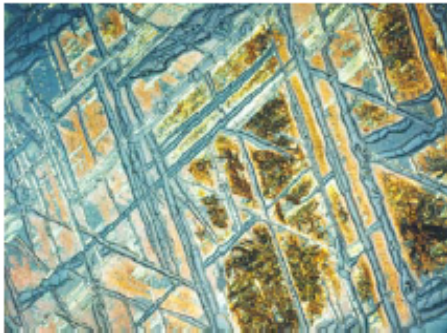


# REACT

## Rare Earth Alternatives in Critical Technologies

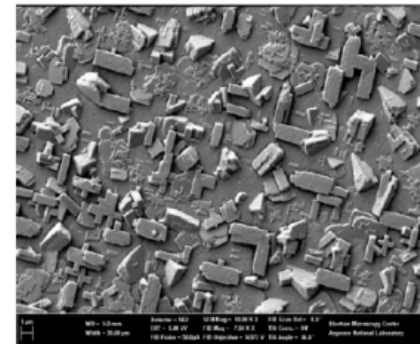
Electric Vehicle Motors (>100 kW)  
Wind Generators (>5MW)

RE-Free  
Magnetic  
Materials



Magnetic FeNi - L1<sub>0</sub> Phase  
in meteorites

Low- RE, high  
J<sub>c</sub> Super-  
conductors

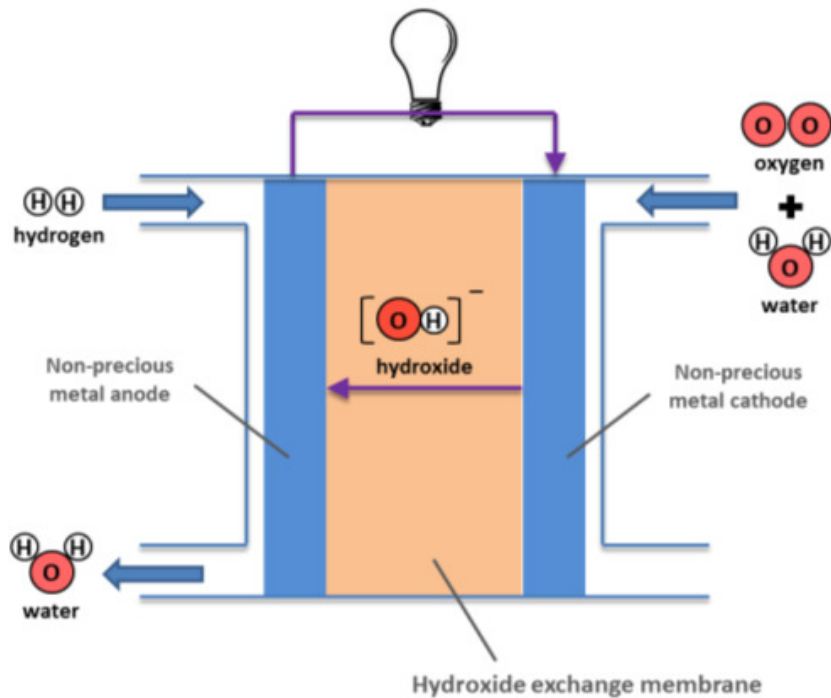


Enhanced 2G HTS wire  
with 4X J<sub>c</sub> Increase

# Enabling Materials

## Energy Storage

New approaches to fuel cells by eliminating the need for platinum



Breakthrough structure-property enabled

## Energy Production

Reducing the cost of PV production



Pure Silicon

1 Machine

Form  
Wafer

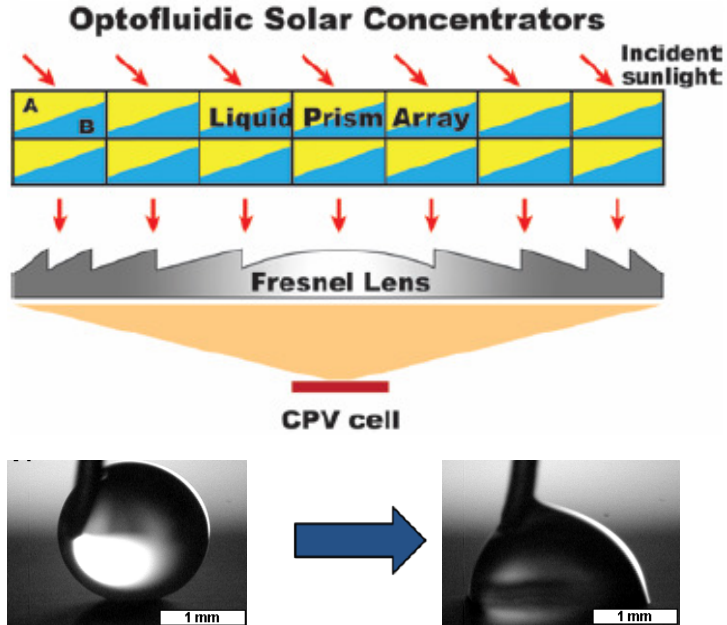
>400W of  
Power / kg

Breakthrough Processing Enabled

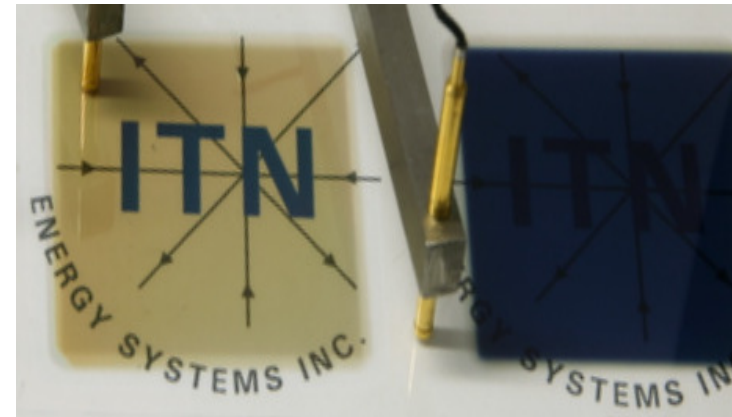


# Intelligent Materials

Elimination of the need for motors to move CSP with liquid lens that can change shape to maintain focus



Low-cost electro-chromic materials can create significant building energy savings



**Intelligent materials create new system-level approaches**

# What makes an ARPA-E project?

## 1. Impact

- High impact on ARPA-E mission areas
- Credible path to market
- Large commercial application

## 2. Transform

- Challenges what is possible
- Disrupts existing learning curves
- Leaps beyond today's technologies

## 3. Bridge

- Between basic science and applied technology
- Not researched or funded elsewhere
- Catalyzes new interest and investment

## 4. Team

- Best-in-class people
- Cross-disciplinary skill sets
- Translation oriented

# Thank you